Davis Pg. 131

**EXAMPLE 5 Studying Particle Motion**

A particle moves along a line so that its position at any time $t \geq 0$ is given by the function $s(t) = t^2 - 4t + 3$, where $s$ is measured in meters and $t$ is measured in seconds. $\frac{f(t+\Delta t)-f(t)}{\Delta t}$

(a) Find the displacement of the particle during the first 2 seconds.

(b) Find the average velocity of the particle during the first 4 seconds.

(c) Find the instantaneous velocity of the particle when $t = 4$.

(d) Find the acceleration of the particle when $t = 4$.

(e) Describe the motion of the particle. At what values of $t$ does the particle change directions?

~~(f) Use parametric graphing to view the motion of the particle on the horizontal line $y = 2$.~~

*continued*

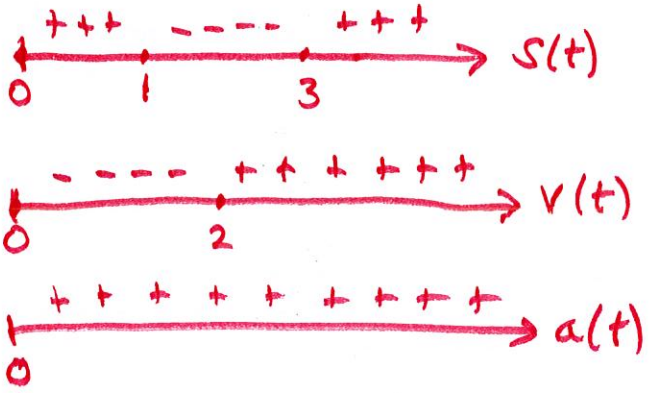
a. $s(2) - s(0) = 2^2 - 4(2) + 3 - (0^2 - 4(0) + 3) = 4 - 8 + 3 - 3 = -4$ m

b. $\frac{s(4) - s(0)}{4 - 0} = \frac{4^2 - 4(4) + 3 - (0^2 - 4(0) + 3)}{4} = \frac{0}{4} = 0$ m/s

c. $v(t) = s'(t) = 2t - 4$ $\quad v(4) = s'(4) = 2(4) - 4 = 4$ m/s

d. $a(t) = v'(t) = s''(t) = 2$ $\quad a(4) = 2$ m/s$^2$

e.




The particle has an initial position of 3 m at $t = 0$. It moves to the left until $t = 2$ when at position $-4$ m when it stops moving. Then it turns around and moves to the right with positive velocity. At $t = 3$ it is at position zero m. At $t = 4$ it is back at position 3 m. It continues to move to the right for all $t > 2$. Its velocity increases by 2 m/s$^2$ the entire time $t \geq 0$.